# the Mechelecin

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THE SCHOOL OF ENGINEERING
GEORGE WASHINGTON UNIVERSITY

**THE MECHELECIV**

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## ● NEW ENGINEERING BUILDINGS?

We have it from the traditional "reliable source" that the University now has a sum in excess of $90,000 in a fund to be used for the erection of a new building for the school of engineering. This is cheering news indeed, but it was not quite so cheering to learn that President Marvin intends to sit tight on the plans for the new building until he can see what effect the generally reduced enrollment resulting from the graduation of most of the veterans will have upon the School of Engineering, and until he has all of the money on hand which will be required for the building, estimated to be about $400,000.

In our view, it is extremely shortsighted to drift along with our present inadequate facilities to see how low our enrollment of student engineers will get. This course can only lead to the deterioration of the School of Engineering. Students enroll in the University which has the most to offer them, and if it is desired to maintain a healthy, growing Engineering School, we must offer the prospective student more and better facilities and compete successfully with other schools.

Last year President Marvin turned down the plans for a new Hydraulics laboratory. The reason he gave for doing this was that he did not want to ask the Board of Trustees for an appropriation for a Hydraulics laboratory which would be a total loss to the University should he later find it necessary to ask them for a much larger appropriation for an Engineering School.

The ME's were more fortunate in their request for better laboratory facilities, according to our "reliable source". An appropriation was made at the beginning of this semester for improvements to the existing laboratory. Preliminary plans were drawn up last summer by Professor Greeley, and now that the appropriation has been made, final plans are being prepared. Professor Greeley hopes to get a steam turbine, a dynamometer, air ejectors, a steam condenser, a condensate pump, a drain tank with float controls and a cooling tower for the laboratory. It is expected that the equipment will be standard units adapted for laboratory testing purposes, and it is expected that installation will begin at the end of this semester. The entire installation is being set up so that it can be moved with a minimum amount of difficulty when and if a new Engineering building is erected.

We believe that the need for adequate facilities for laboratories for the Engineering School is so great that the University administration should utilize a device that many churches have used when their budget could not cover a complete new church building. These churches have drawn up their long-range plans, and then built only the basement, holding their meetings in this basement until they could afford to finish the church. This scheme would be particularly apropos in our case, since we understand that the laboratories are to be in the basement anyway. If this were done the entire laboratory problem would be solved, and long and arduous work would be spared the professors, who must be continually devising stopgap arrangements to keep the bulging laboratories operating in a reasonably satisfactory manner.

## ● MECHELECIV STAFF POSITIONS ARE OPEN

In any college publication there is a considerable turnover of staff members from year to year, particularly because of graduations in June of each year. Usually, when the school year opens there are a few hectic days on publications, getting the new staff lined up and the first edition out. For several years now, this magazine has followed a slightly different policy in this matter, aimed at getttng the first issue of the year out with full information of the first month's activities at a time when it will be of most help to the new students.

Toward the end of each school year, Mecheleciv starts to form its new staff for the next school year. By getting at least the skeleton setup in shape, the first issue of the new year can be published on time. This year is no exception, and even now the plans for the new staff are being made. Positions are now open, and those students who are interested should contact

the editors and get their qualifications in the record for consideration.

Some of the staff positions will be filled before the May issue goes to press, so that the new staff will have at least the experience of one issue behind them when the new year starts. In this connection it should be remembered that practicing engineers in responsible positions have repeatedly stressed to us the fact that engineers should try harder to prepare themselves for the fields of writing and speaking for their future careers. Staff membership on a college publication is an excellent training for young engineers in writing and publication work, and it should be particularly helpful to serve on an engineering publication, where the terminology and material are in the field to be followed by the student in later years.

The spirit of mutual cooperation which is developed in the production of a magazine of this type is a thing which is rarely achieved in any other field. The men who work on the magazine rarely have any skill at the time they first join the staff, but as they find themselves compelled to produce in order to meet deadlines, they develop the abilities required.

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***About Our Cover . . .***

*A view of the Washington railroad switching yards, showing the "round house", where locomotives are overhauled. An article on diesel locomotives will appear in the May issue of the MECHELECIV.*

## from the editor's mailbox

*This space is intended to serve as a forum for student and alumni opinion. Opinions expressed are those of the writers, and not necessarily those of the* MECHELECIV. *Address communications to: Editor's Mailbox, the Mechelecіv, Student Union Annex, George Washington University.*

—THE EDITORS.

Gentlemen:

If your publication would really like to render a service to the engineering students of this university why don't you initiate an investigation of the Physics Department? In a recent test in one of their more advanced courses the mortality or flunking rate was about 90%. Needless to say, I was included in this number. Despite this fact, I feel that an exam is not only a test of the student's knowledge, but also of the teaching ability of the instructor. In an exam with a mortality rate this high, I think the teacher is overestimating the powers of his instruction or has a demented mind and says "Flunk them the first time and they will work harder the second." It is possible for an instructor in any course to give such a test, but what does it prove, beside the fact that he is a poor instructor? The subject matter of this course is not particularly difficult, but a better text than that required for the General Physics courses is required to work the problems. I came to this University with the idea that there was some relation between Physics and engineering, but I am rapidly losing it, and feel that the majority of my fellow students have the same idea. Unless some corrective measures are taken, I feel that the engineers are going to go out into the professional world with a contempt for what should be a brother profession that will be a hindrance to both classifications.

Needless to say, I would prefer publication under a nom-de-plume, as I have further Physics courses to take and would not place them above the plane of taking retributive measures.

Sincerely,

H. P. O.

● *We get these so often that we finally printed one.*—ED.

Dear Editor,

In the March issue of the Mechelecіv there appeared an article concerning myself which was entitled "Engineering Personalities." The story ended with a brief explanation that I began writing for the Hatchet after becoming dissatisfied with the publicity given the Colonial Series.

As a result of this item, I have received a note from the Chairman of the Hatchet Board of Editors informing me that "it has never been the desire of the school paper either to force anyone to continue on the staff when that person feels he is there only by default, or to see itself referred to in another campus publication as a sort of unwitting tool used by a student for his own purposes."

It was unfortunate that this blast was made at me before I had even been approached concerning these false implications. The truth of the matter is that I informed a member of the Mechelecіv staff that I joined the Hatchet staff because I was not satisfied with the publicity the series received in the Hatchet. At times incorrect information was inserted, or material which I thought important was omitted. In addition, since I am responsible for all program arrangements, I consider myself a more reliable and convenient source of information on this particular series of programs.

If there is any insinuation that this article is a half-hidden slur at inefficient publicity, perhaps the shoe fits, if it does, that is not a matter for which I feel any apology is necessary. As for using the Hatchet for my own purposes, I was under the assumption that the stories concerning the Colonial Program Series were published because of their news value and content—not as an accommodation for my personal benefit.

Leonard J. Grant
Student Council Program Director.

# A Universal Automatic Computer

*by Andrew Covert Anders*

Great progress in electronic engineering has made possible a fundamentally different and immensely fruitful approach to the problems of science and business today. In science, a major problem is the numerical solution of those mathematical expressions which lead to extremely complicated computational procedures. Engineers in many fields must use models, wind tunnels, trial and error, and rule of thumb, not because their problems cannot be expressed mathematically, but because the time required to compute a numerical solution to the problem is prohibitively long.

Another general problem which electronics is now tackling is the logical handling of huge masses of data which arise in science, statistics and the routine work of a business office. All these difficulties can be successfully attacked by the ultra high-speed electronic digital computer.

One of the most interesting of the computers of this type, sometimes called "giant brains", is the UNIVAC*, the first of which is now being built by the Eckert-Mauchly Computer Corporation*, of Philadelphia. Interest in the UNIVAC (Universal Automatic Computer) lies in its great flexibility and its large use of electronic circuits.

Two important properties permit the electronic digital computer to approach these formidable problems.

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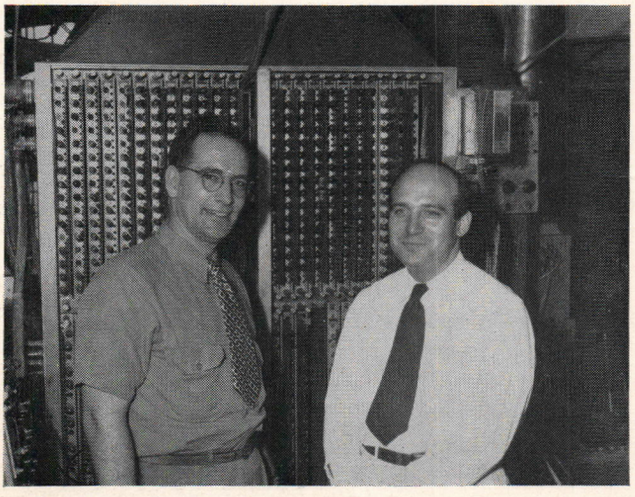
* A subsidiary of Remington Rand, Inc.



*Dr. John W. Mauchly and J. Presper Eckert, Jr., designers of the UNIVAC, with a computer section under test.*

The first is the extremely high speed, measurable in microseconds, with which each elementary operation is carried out. Only the use of electronic circuits permits speed as high as the UNIVAC attains. An even more significant characteristic is that, once a problem is prepared for the computer, or "programmed", the computing process is completely automatic from the time the operation is started to the time the results are removed.

Herein lies the reason that recently developed large-scale computers represent a new concept in the computing machine field. There is no great differential between the time it takes for a single operation to be accomplished and the time it takes for the next operation of the computational procedure to be set up. An operator using a conventional desk calculator must determine the operation to be performed, enter the information manually, then initiate the operation. No matter how fast the computer itself operates, the process is limited by human intellect and manual dexterity. In a computation of considerable length, these limitations are severe indeed.

A satisfactory high-speed computer must be able to store the information and instructions required for a long problem, carry them around to various places in the machine, and use them to perform computing operations until the problem is complete. In a computer like the UNIVAC, the times required to perform these various processes are comparable, and are of the order of thousandths of a second.

The UNIVAC is the central computing element in the complete UNIVAC System. Auxiliary equipment for the system may include machines for typing on magnetic tapes from a manual keyboard, up to ten high speed tape handling machines, called UNISERVOS, which are hooked directly to the central computer, machines for operating electric typewriters from magnetic tapes, and a supervisory control desk used mainly for trouble shooting in the main computer. In addition, two devices, one for converting from magnetic tape to cards and another for converting from cards to magnetic tapes, may be used with the main computer.

In order to compute automatically at high speeds, the UNIVAC holds all information pertaining to a problem quickly available either from the internal memory or from one or more of the ten UNISERVOS. It must have the actual data of the problem, such as

the constants used, and it must have explicit instructions with which to operate on the data. An instruction code designates what operations are to be performed on data, and also how data are to be transferred from one part of the computer to another. Both coded instructions and numbers are arranged in a manner which permits the computer to proceed with the solution of the problem from beginning to end without intervention by the operator. A sequence of coded instructions forms a "program" for the machine.

A program must be put into the computer so that it can be stored, or "remembered", and made available to the various functional circuits which will use it to compute. In order to do this, programmed information is first put on magnetic recording tape by the magnetic tape typer. The tape typer has an alphabetic and numeric keyboard. As a character is typed, it is translated into a binary code, which is represented on the magnetic tape by a series of magnetic pulses. It is this coded binary language which permits electronic handling of information throughout the system. One or the other of two binary symbols may be represented by an electronic pulse or lack of a pulse at a particular time. A vacuum tube may "speak the language" by either conducting or being cut off.

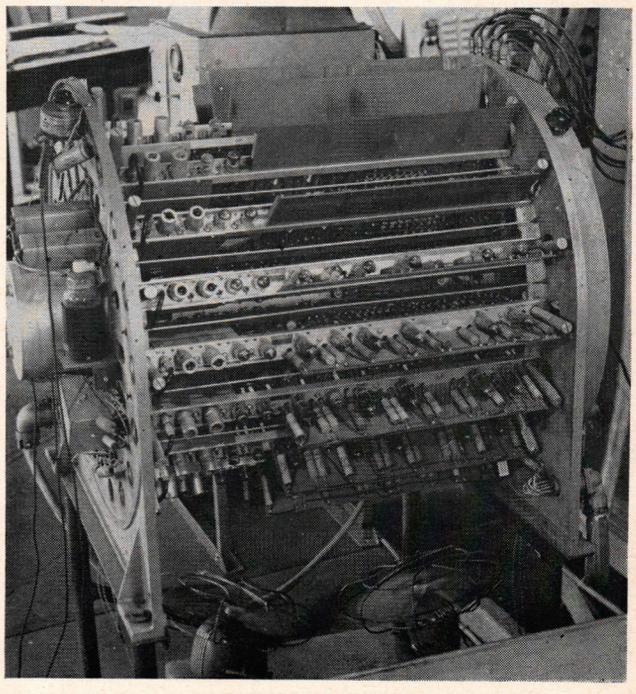
Tape containing the program is placed on a Uniservo, which runs the tape, reads it, and sends the information to the UNIVAC itself. The UNIVAC accepts this information into its internal, or high-speed memory. It was mentioned that the computer holds information put into it and makes the information quickly available to the computing circuits. These are essential characteristics of an ultra high-speed automatic computer. They are provided by the internal memory. A satisfactory memory device must store a great deal of information, yet each bit of information must be accessable in a length of time comparable to the time required to perform arithmetic operations. If the "access time" of the memory were too long, the overall speed of the computer would be seriously limited. In the UNIVAC, this time is a fraction of a thousandth of a second.

The internal memory of the UNIVAC has 1,000 memory positions, each holding one "word". Each word may consist of an eleven decimal-digit number with sign, or two instructions, or 12 characters in alphabetic form. When the operator initiates the computing process, the UNIVAC looks into a particular starting memory position for its first instruction. It then proceeds with the problem on its own, following a large and versatile instruction system. It performs arithmetic operations, compares numbers, and transfers from one instruction or group of instructions to another, until the problem is completed.

An instruction has two parts, an "order" and a memory position. The order determines what operation is to be performed. The memory position is a four-digit number from 0000 to 0999 which designates the location of the data to which the order refers. Instructions may send numbers to various registers of the computer. A register is an electronic device for holding, or representing, a binary code group while it is operated upon. The instruction A0005, for example, means that the number in memory position five is sent to the A, or accumulator, register. If there is already a number in A, the new number will be added to it, and the total will be stored in A.

A problem in which a particular sequence of operations must be repeated over and over, perhaps using different data, is especially easy to program for the UNIVAC. Use of such "sub-routines" allows great economy in the instructions required for a problem, and is an important advantage of the computer. Once the instructions for one iteration are established, constants can be placed in the program so that the sequence is reiterated as many times as necessary, using the same instructions over and over, perhaps until a comparison test made by the computer shows that iteration is no longer required. Many business routines as well as mathematical computations involve such repetition of a process.

Present-day business machine installations require that the machines be re-wired when each different type of operation is carried out. Different combinations and sequences of machine operation must be used. In the UNIVAC system, when a particular routine is called for, the tape carrying instructions for



*An electronic "memory" device under test.*

that routine is loaded into a Uniservo. Data to be put through the routine is entered on the same or upon other tapes. The instructions control the whole operation from beginning to end. Then the tape is filed away until the same routine is required in the future. An office routine, however complicated, need be set up only once.

The results of a mathematical problem or business operation, which may be a very large group of data, are recorded by a Uniservo on magnetic tape, which can be filed away, used in a succeeding problem or operation, or put on the magnetic tape printer. Results are read from the tape by a magnetic pickup head and printed on paper by an electric typewriter. Instructions can be put in the program to control the printer in such a way that it will present the data in almost any desired format. Spacings, indentations, headings, and so forth may be produced automatically.

Operation of the central computer and the Uniservos may be controlled from a panel on the supervisory control desk. An electric keyboard is included on the desk, and a problem may be transferred directly into the machine from this position. Data from the computer may be typed by a directly connected electric typewriter onto a sheet of paper for checking purposes. For most operations, however, it will be more convenient to put complete instructions for the entire system on the input tape. This will result in completely automatic operation.

Up to ten Uniservos can be connected in the system to read in, read out, and hold information for future use. Instructions can be given by the system to use these Uniservos, each of which holds a reel of tape over a thousand feet long. Each tape holds over one million decimal digits, and digits may be read in and out of the tape at the rate of nearly 10,000 per second.

Advantages of such a system are numerous. The use of magnetic tape not only allows high speed, but is very compact. Inventory or accounting records, for example, may be stored in a small space. Because alphabetical as well as numerical information can be handled at the same speed when sorting data, it is unnecessary for office personnel to put information into a numerical code, as must be done in the present business machine installations.

Business and science have literally waited for the high-speed automatic computer. Difficulties presented by the time and labor needed to analyze facts have long been recognized. Over one hundred years ago Charles Babbage envisioned a purely mechanical *analytical engine* which would perform computational operations automatically in sequence. The technical limitations of his era, however, frustrated his efforts to construct one. The modern engineer, using electronics, has made such a concept a reality.

Mathematical problems in science and engineering are most usually cited as being highly fruitful fields for ultra high-speed computation. For example, problems which contain a slowly converging series, or which require many iterations of an arithmetic procedure, are tailor-made for such machines. It is interesting, however, that the idea of using electronic techniques for computing arose in a somewhat different field.

Before the last war, Dr. John W. Mauchly was interested in the statistical study of weather. A tremendous number of meteorological observations are made every day throughout the nation and throughout the world. If this information could be evaluated quickly enough, and statistical methods applied to it, weather predictions might be made much more accurate. Long-range weather forecasting could become a practical reality. The great amount of data to be handled, however, made the problem seem impractical. Dr. Mauchly became attracted to the possibilities of using electronic circuits to handle data at high speeds. He joined the staff of the Moore School of Electrical Engineering of the University of Pennsylvania. Here he became associated with J. Presper Eckert, Jr., then a graduate student at the school. During the war, the two designed the ENIAC for the Army Ordnance Department. It was the first successful high-speed computer using electronic tubes. It is still working, very successfully, at Aberdeen Proving Ground.

An example of the scope of high-speed computing applications is provided by some conditions under which the UNIVAC was conceived. Original study of the computer was partly supported by the Bureau of Census, through a contract of the National Bureau of Standards. The Census Bureau was interested in the suitability of the UNIVAC for their very extensive statistical procedures. The whole problem of statistical mathematics and the sorting and collating of information was considered in the design of the computer. Thorough investigation showed that the UNIVAC could handle these operations, as conceived in earlier proposals.

Business organizations will profit as well as engineering activities. A great many firms have high costs for record-keeping, accounting, engineering design computations, cost and market analyses, and even inventory control. According to one Eckert-Mauchly executive, "UNIVAC operation can save many firms substantial sums in both personnel and time. Electronic computation can be used in almost every business operation."

The new method provides opportunity for an entirely new business. Firms which haven't enough work to keep such a fast computer busy could still realize

*(Continued on page sixteen)*

# The Behavior of Metals at Low Temperatures

*by W. B. Allison*

Since the time when physics proved that atoms exist, and that heat is the movement of atoms, it has been recognized that refrigeration is, in essence, the slowing down of atomic motion by the removal of energy. This rather simple idea of the nature of heat in motion and of temperature as the intensity factor of heat in motion, accounted for a long time for all of the important phenomena encountered in the practice of refrigeration.

At high temperatures the molecules stay apart despite their mutually attractive force due to the high intensity of motion. As one proceeds down the temperature scale the attractive forces between the molecules begin to pull each other together, condensing a gas to liquid, and liquid to solid. With further cooling, the temperature at which atomic motion stopped was regarded as absolute zero, 273.16°K or 459.69°R.

In 1925 the theories of quantum mechanics were developed, leading to a somewhat newer concept in the low temperature field. It became clear that in the zero or lowest energy level there was still motion present. It became significant that the absolute zero temperature was not perfect stillness, but perfect order.

The development of thermodynamic theories led to the concept of entropy; the measure of the amount of disorderliness in distribution of energy, or the motion of atoms. As the motion decreased, the entropy decreased; that is, there was less disorder or more perfect order. By this concept, refrigeration was essentially the removal of disorder.

Carrying the idea further, one was led to believe that absolute zero was the region of perfect atomic rest, the region where nothing was expected to happen—no chemical reactions, no physical changes.

It was quite a shock to find phenomena appearing at very low temperatures. Liquid hydrogen and liquid helium were far from having the character of stillness.

In 1911 it was discovered that at a temperature of 4.12°K mercury lost every trace of its electrical resistance and became a perfect conductor. In such a super conductor, the electrons can move with such freedom, without friction, that once set in motion they can circulate forever. In this region of very low temperatures, which had been believed to be the region of absolute rest, there was discovered what might be truly perpetual motion.

In 1935 Wilhelm, Meissner and Clark discovered that at a temperature of 2.2°K liquid helium developed the extraordinary capacity to flow through tiny apertures apparently without friction, and this frictionless flow enabled it to creep over surfaces with remarkable speed.

De Haas and Voogd found that tin changed its resistance very slowly with temperature until at 3.7°K the resistance dropped so sharply that 50% of the resistance was lost in a range of $10^{-4}$ degrees. So far superconductivity has been discovered in only 18 pure elements and 40 or 50 alloys.

The metal having the highest superconductivity temperature has been found by Dr. F. H. Horn of Johns Hopkins University to be columbium nitride. He found that this metal exhibited superconductivity at a temperature as high as 14° or 15°K. The rate of change of resistance with temperature is not so great as in the case of tin, but it is still hundreds of times higher than any rate obtained in any other type of ordinary resistance change. Since this change of resistance with temperature is one of the most useful effects for measuring and detecting small temperature changes, columbium nitride has offered interesting possibilities as a resistance thermometer or bolometer.

A bolometer is a small strip of metal on which radiant energy can impinge, raising the temperature of the strip and changing its electrical resistance, thus permitting a measurement to be made of the amount of energy impinging. In measurements of this type, it has been recognized that speed and sensitivity are two desirable qualities, and for use at ordinary room temperatures thermal fluctuations of the electrons constitute the final barrier against any increase in sensitivity.

Dr. Horn found that by lowering the temperature he decreased the thermal fluctuations and thereby increased the sensitivity of the bolometer. To operate and maintain the sensitivity, the bolometer has to be maintained at a temperature in which the columbium nitride strip is in the middle of the transition zone. In this zone a small change in temperature causes the largest possible change in resistance. It has been found possible with such a bolometer to detect changes in temperature as small as $1 \times 10^{-7}$ ° C.

To each end of the columbium nitride strip there are attached wires leading to a small audio transformer. A battery is connected so that a small d.c. current of approximately 10 milliamperes flows through the transformer and bolometer strip. Thus any change in the resistance of the metal strip causes a change in the current flowing through the primary

*(Continued on page nineteen)*

# Machine Design
## The Foundation for a Successful Engineering Career

**by G. F. Habach**

*Chief Engineer of the Centrifugal Engineering Division,*
*Worthington Pump and Machinery Corporation.*

There has been a definite recent tendency for the competent engineering graduate to avoid the field of machine design. This is often the result of his experiences in his undergraduate drafting and designing courses. Unfortunately, such courses cannot begin to simulate actual practice, and the student must take for granted many apparently arbitrary and meaningless rules regarding linework, dimensions, proportions and procedures. The hours spent in the drafting room are regarded by most students as drudgery of the highest order. It is understandable, therefore, that many graduates honestly believe that a position in the engineering department is equivalent to the unpopular drafting and designing courses, except that one suffers a daily 8-hour dose instead of 3 hours a week.

Fortunately, designing is not a dull, tedious, dead-alley occupation. The engineering department is creative, fascinating and challenging. It requires the broadest possible understanding of technical, commercial, manufacturing and human problems. It is frequently the stepping-stone to the most responsible executive positions. When I describe to you some of the functions of a modern engineering department, I am certain that you will recognize the opportunities it offers.

The past twenty years have brought significant developments in industrial product design and engineering. During the depression years, competition became exceedingly severe. It was necessary for the engineering department to keep in close touch with the market, to reduce manufacturing costs and to give the product eye appeal, but still be strictly functional in its operation. As a result, the designers were forced to become customer and cost conscious, in addition to contending with more involved technical problems. As a consequence, men proficient in these broader fields became the successful designers. Important changes also occurred in manufacturing procedures. New social standards for the protection of workers became established as unions expanded in membership and importance. Tremendous expansion was necessary both in personnel, in space and in equipment. This usually meant a new building or complete renovation of existing facilities. The modern engineering department is usually located in a very attractive building, well lighted, clean and often air-conditioned. Many new and important positions were created.

The War period also contributed to this change. Tremendous expansion of manufacturing facilities were necessary. Shops doubled and re-doubled in size and their personnel was for the most part recruited from occupations that had no previous knowledge of shop practices. To utilize these people, a complete revision of manufacturing methods was necessary. The manufacturing quantities permitted the use of special machines and fixtures that, for example, allowed an ex-taxi driver to do the work that formerly required a skilled machinist. The drawings issued to the shop changed in character. The designs were altered to suit the new manufacturing methods, and every detail of fabrication procedure was completely specified. The drawings and shop specifications of the Engineering Department became the law.

The end of the war has seen business activity continue on practically the wartime levels and basis. Most manufacturing is now done on an incentive system, where the incentive is usually on the basis of quantity. The drawings specify the quality by using tolerances on dimensions to indicate the acceptable limits and specifying requirements of surface finish, squareness and concentricity. Each operation is given a "standard time" and the shop man is paid accordingly. You can be assured that no operator will do any work for which he is not paid. In fact, a rigorous inspection is necessary to make sure he has done what he is paid for. This situation has placed an entirely new responsibility on the designer.

The user of the product finds himself in a similar position. His operators are also lacking in special skills, and he expects the supplier of his equipment to recognize his problems. For example, the new line of Westinghouse Life Line motors has sealed-for-life bearings which require no maintenance or time on the part of an operator. The user expects the machine to be foolproof and as automatic as possible in operation, and insists on receiving a complete and understandable instruction manual. Such

manuals describe the machine and how it functions, the precautions that are to be taken if it is stored uncrated, and how to set it up and operate it. The possible operating troubles are listed, inspection and maintenance procedure are indicated in detail, and a complete parts list is included. Special drawings and photographs are often essential.

Responsibility for the preparation of the instruction book falls on the designer, so that in addition to first-hand technical knowledge of his machine, he must know its mechanical functions and requirements from personal observation on the erection floor and on the test stand. He must also be aware of the customer's personnel problems and operating system. The knowledge of the customer's system is extremely important. For example, a boiler feed pump may be designed for hot water operation, yet when starting up the power plant for the first time cold water may be handled. The pump must therefore be designed to survive a severe thermal shock. Heaven help the designer who has not provided for the differential thermal expansion of the bolting and in the running clearance during this period. The parts list and recommended spares give the designer a direct opportunity to turn salesman and to add profitable business to the organization, and more important, to protect the customer. Naturally, to fulfill these objects the design engineer must have first-hand knowledge of customers' problems. This means travelling on occasion to the customer's plant to observe first hand the conditions under which this machine is to operate. Should the machine fail to function satisfactorily, the design engineer would be called upon to work out the problems on the site. He is expected to carefully follow the history of each installation of the machine he has designed.

The designer must, therefore, not only be fully cognizant of the machine shop procedures and be able to trace through each operation progressively to make certain he finally obtains what is needed, but he must also recognize and understand the whole social structure in which he is working. With this greater responsibility goes increased stature in the organization for the design engineer.

Don't think the engineering department does the entire job by itself. Rather, it is a most important cog in a very complex system. To indicate just a few of the departments with which the designer works closely, I list the following:—

(1) Sales: It is the salesmen that are in continual contact with the market and must furnish the market analysis and report on competitive situations. However, salesmen are often a bit naive and they may request a product that has every possible sales feature and indicate a selling price that is a fraction of the manufacturing cost that will exist if all the desired features are provided. The designer must have the ability to sift the Sales department's requests and must "sell" himself and his designs to the Sales department. If he does this well, the Sales department will do equally well in selling the product.

(2) Research: The function of the Research department is to develop fundamental technical information for the designer and to plot the course for future developments. The closest cooperation between the designers and Research is needed. The facilities of the Research department are usually limited, so it is an able designer who can convince the Management and the Research department to study vital problems that affect his particular field of interest, and who then has the competence to convert this information into a commercial product. The design perspective and commercial judgment to separate the significant information from the non-essential and to develop a profitable product is the primary objective of the Engineering Department.

(3) Production: The fabrication of a design presents many problems. Only by fully understanding the methods of the Pattern Shop, the Foundry, the Weldery, the Forge Shop, Machine Shop and the Erection Shop, and the commercial sources of the raw material used in manufacturing, can the designer do full justice to his job. One specific example is the ball bearing cartridge designed to permit the axial adjustment of the rotor of a centrifugal pump. This cartridge involves a "bore" in which the bearing fits, a "turn" for centering the cartridge in the pump frame and a mounting flange. If the design permits the bore, the turn, and facing the flange in one setting on a lathe, the design inherently insures concentricity and squareness. If the part has to be repositioned in the machine to make either the "bore" or the "turn" the inherent concentricity is lost in spite of the use of close tolerances. The designer must be able to trace every operation in the fabrication of the part, and be guided by the limitations and inadequacies of the various processes. He must know his shop practice and the limitations of the machine tools available in his organization.

(4) Test Department: The performance tests of the components and of the completed machine gives the designer shop proof of the ability of the design to function as per specifications. There is a tremendous inner satisfaction when, starting with no more than the required performance and a sheet of paper, you are able to produce a design which will perform as required and yet not be overdesigned or underdesigned. On a centrifugal pump the target is often distressingly small and the pump must hit the bullseye to be satisfactory. If you play it safe and over-

*(Continued on page seventeen)*

# NEWS AND VIEWS

## YOUNG ENGINEER'S PRIZE

The Washington Society of Engineers offers a prize of $40.00 in cash and a two-year membership in the Society for the best paper on any engineering subject. Here is an excellent opportunity for some young student engineer to win a worthwhile award. It could also provide a stimulus for better term papers. The competition is open to all under the following rules:

1. The Washington Society of Engineers' Young Engineer's Prize shall consist of an award of forty dollars in cash and membership in the society for a period of two years.
2. The competition for this award will be open to members of the Society not over thirty years of age or students in engineering in a university located in Washington, D. C., or within a radius of twenty-five miles therefrom.
3. Each candidate for this award shall submit a paper, prepared by himself, on an engineering subject or related to an engineering project with which he has been connected.
4. The paper or papers submitted will be judged by the Committee of Award, above referred to, and this Award will be given for the paper deemed most meritorious by the Committee of Award.
5. In the event the Committee of the Award is of the opinion that no paper submitted is sufficiently meritorious to meet the standard contemplated by the Society in establishing this award, then no award shall be made for that year, and the decision of the Committee of Award shall be final.
6. The presentation of this award will be made at the annual dinner of the Society and the announcement of the competition for the following year will be made when notices are issued for the first meeting of the Society to follow an annual meeting.

Papers must be submitted before May 30, 1950 in duplicate to: Frank L. Weaver, Chairman, Committee on Awards, Washington Society of Engineers, 15 Keswick Street, Garrett Park, Maryland.

## JOB PROSPECTS DECREASE

The A.S.C.E. Public Information Service reports in a recent bulletin that a 30 percent drop in employment of this year's engineering graduates is predicted by leading industrial concerns, government and state agencies, and engineering colleges, canvassed in a recent study of 1950 employment programs conducted by the General Survey Committee of Engineers Joint Council. Results of the survey were made public at a meeting of the Council, national organization representing more than 100,000 engineers, held March 17 in the Engineering Societies Building, 33 West 39th Street. Reporting organizations included 144 industrial companies, 23 government agencies, and 64 engineering schools, which are currently employing 91,400 engineering graduates.

A decrease of 28 percent in employment by industrial companies and of 33 percent by government agencies is indicated by the survey. Engineering colleges, polled concerning teaching and research positions available, report a probable drop of 44 per cent from last year's employment figures. Only chemical companies of the large industrial groups do not expect a decline in employment. In line with this, a decrease of only 5 percent from 1949 is expected in the chemical engineering field, whereas estimated employment decreases in the other engineering fields are all about 30 percent.

Graduates in physical science also face reduced employment opportunities, according to the Engineers Joint Council survey. Polled organizations employing such graduates expect a 16 percent drop from last year's figures. Although employment of chemists will probably decrease by 14 percent, a 7 percent increase in employment of physicists is expected.

Average starting salaries of $225 a month for graduates with bachelors' degrees are about the same as for last year, with chemical and petroleum companies offering the highest salaries. For graduates with masters' degrees, the average will be about $320 a month, and for those with engineering doctorates $445. In the engineering colleges, employing teachers and research workers however, $390 will be the average starting salary for graduates with doctors' degrees.

### ENGINEERING SCHOOL CALENDAR

*April 1950*

**April 4—Tuesday—Mechelecive Staff Meeting, 8:15 P.M., Student Union Annex, Room 303.**

**April 5—Wednesday—Societies Meet, 8:15 P.M.**

**April 12 thru 15—ASME Spring Convention, Statler Hotel.**

**April 12-26—Theta Tau Meeting.**

**April 13—Thursday — Engineers' Council, 8:15 P.M., Student Union Annex.**

**April 19—Wednesday—Sigma Tau Meeting.**

**April 29—Mechelecive Out.**

## STUDENTS VISIT SEWAGE PLANT

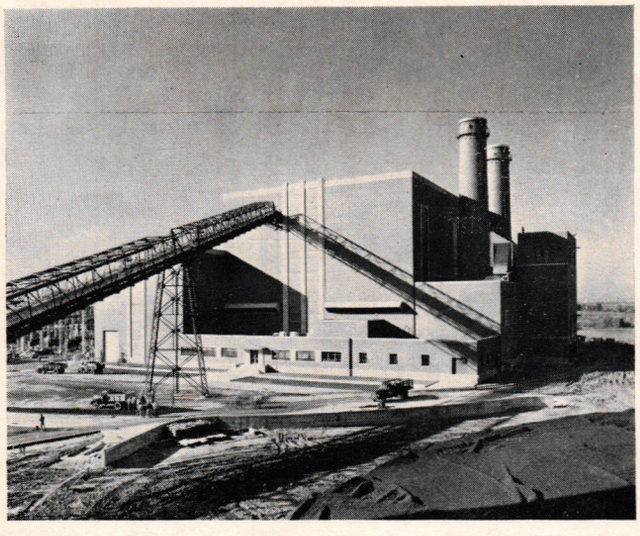
On Wednesday evening, March 15, the CE's in Mr. Fuhrman's sewerage class were taken on a field trip to the District of Columbia's main sewage pumping station. The station is housed in a brick building, a few generations old, covering a block behind the Navy Yard on First Street, Southeast. All sanitary and storm sewage collected in the city congregates at this point. The sanitary sewage is pumped to the District's sewage treatment plants and the storm sewage is emptied into the Anacostia River a block away. The class was taken through the entire plant and the various operations, including screening, pumping, and siphoning were explained.

A storm water screening chamber about 20 feet high and 40 feet wide in the basement of the plant was inspected. This chamber is fitted with heavy steel doors that are used as bulkheads during periods of heavy storms when the sewage is flowing above the basement level. Another interesting feature of the trip was the 800 horsepower diesel engine, obtained from Government surplus, which can be used as an auxiliary generating unit in case of power failure. Even the CE's, who are generally aloof on matters of electricity, seemed interested. The trip was very informative, if not exhilarating, and the general comment was, "You'd probably get used to it".

## E E FIELD TRIP

Twenty of the EE students from the University, accompanied by faculty members J. Antel and J. LaHatte, visited the new Potomac River Generating Station of the Potomac Electric Power Company on March 8th. This plant, the most efficient generating station of its type now in operation in this vicinity, produces one and a quarter kilowatt hours of energy per ton of coal, and is a fine example of the progress being made in the field of engineering.

Potomac River Generating Station



Detailed maps were provided by PEPCO to direct the students to the plant, and on arrival they were welcomed most courteously by Mr. Robinson, the Chief Engineer of the plant. After this, ten-page mimeographed pamphlets were issued to all members of the party, to provide information on the various parts of the installation as the group proceeded through the plant.

The main building of the plant is of an architectural type that blends well with the surrounding neighborhood. The smoke stacks are kept low (35 feet higher than the main portion of the building) because of the nearby National Airport at Gravelly Point. In spite of this low stack height, the system for removing fly ash is so efficient that more than 99% of the ash is eliminated, thus decreasing the smoke nuisance in this residential area. It was of interest to note that over 100 cubic yards of this ash is collected every twenty-four hours.

Mecheleciv readers will remember a story in the November, 1949 issue, describing the Alexandria Generating Station in detail.

## ENGINEERS' COUNCIL MEETINGS

As the Mecheleciv has not published a report of the Engineers' Council meetings since December, a brief account of the January and February meetings is included in this article.

In January the Council meeting opened with the financial report of the Mecheleciv. The report showed that the magazine was still in the black, thanks to the help of the alumni and the untiring efforts of the advertising staff. Edward Egloff, representing Sigma Tau, presented his credentials as replacement for Joseph Irico, who recently graduated. Irico had replaced George Gelly, who left school due to ill health. Egloff also took over the post of Council secretary, a post vacated by both Gelly and Irico. Three secretaries in one semester may have set a record for the Council.

During the busy meeting, plans were discussed for: the Engineers' Mixer, held February 8th at Ruby Foo's Den; registration assistance; and the Engineers' Ball held February 17th at the Hotel Washington. The Council was again unable to come to a decision as to a theme for the Engineers' Ball. The decoration idea of using artificial palms festooned with live monkeys and parrots (to be rented from some pet

*(Continued on page nineteen)*

# ALUMNEWS

*John Morgan,* BME '49, is a member of the engineering staff of the Johnson Service Company. At present he is assigned to the Washington office. John will probably never read this article, since fishing season and our publication date come so close together. He is such an avid fisherman that he once seriously tried fishing on a Theta Tau fishing party.

———

Another Colonial has been located at the University of Maryland. *R. E. Sugg,* BME '48, is a full time graduate student in pursuit of his Master's degree. *Wally Kistler,* previously mentioned as being a graduate student at Terrapinville, came up with two big A's for two courses last term. Nice going, Wally. *Dick Eldich,* BME '49, is another graduate student but Dick is at Johns Hopkins University.

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*John Dallas,* BEE '49, is undergoing training preparatory to being commissioned in the United States Coast Guard. His present station is New London, Connecticut. Anyone who has taken one of John's famous Sunday afternoon cruises will realize that the Coast Guard is getting a real sailor in John. Also in uniform is *Jim LeCroy,* who is soon to be commissioned an Ensign in the United States Naval Air Corps. Jim is a member of the Pensacola Training Station's crack Cadet drill team, and was recently nominated Honorary Ensign of his Cadet Class.

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*Allen Jones,* BME '49, is employed as a sales engineer by the Washington office of the Peabody Engineering Company. *Don Ollendorf,* also BME '49, is an air conditioning engineer with United Clay Products Company, Carrier Division.

———

*Adolph C. Hugin,* BS in EE '28, is engaged in the practice of patent law here in town. Mr. Hugin was formerly employed as a patent attorney for General Electric Company. In addition to his private practice, Mr. Hugin also conducts an evening course in patent law at Catholic University.

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*Jimmy Sinsabaugh,* BME '49, who was one of the more agile GWU students, is located in the Turbine and Gear Section of the Navy Department, Bureau of Ships. Other recent graduates who are now employed by the Navy are *Bob Lee,* also at Bureau of Ships; *Norman Miller,* with the Naval Ordnance Laboratory; and *Bill Gaines,* at the David Taylor Model Basin, in Carderock.

———

*Don Davis,* BCE '49, is an estimator with T. B. Greenstreet and Sons, a local masonry contractor. Don endeared himself to the custodial staff of the University last year by encasing the annual Christmas tree base in one cubic yard of concrete. The staff spent the balance of the holidays figuring out how to dispose of Don's masterpiece. Needless to say, cement was banned from this year's project.

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A new address for last year's Engineers' Council President, *Larry Brown,* is 772-A Broad Street, Pennsauken, New Jersey.

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*Girard Jetton,* BS in Eng '46, is a third year student in the Harvard Law School. Girard recently took time from his studies to marry the former Merna M. Riddell of Washington. The couple now resides at 105 Fresh Pond Parkway, Cambridge 38, Massachusetts.

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*Joseph Crupper,* BME '49, is employed as a heating engineer by the John G. Webster Company, of Washington, D. C. After considerable argument, he was almost aroused from the stupor of matrimony to attend a recent fraternity party, but something must have happened, because Joe wasn't there.

———

*Ken Brown,* BEE '49, is working for the Interior Department. Incidentally, Kenny and the former Imogene Tinsley were married on Saturday, March 11th, and are honeymooning at Williamsburg as we go to press. Congratulations and best wishes from the Mechelecіv, Kenny.

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Congratulations are also in order for *Al Spinks,* BEE, who is a recent papa. The sex was not stated in our correspondent's report. Al is with the High Voltage Laboratory of the Bureau of Standards. Also at the Bureau are two of our more recent alumni, *Stan Russell,* BME '49, in the Materials Testing Section and *Bob Surine,* BME '49, section unreported, maybe testing beer meters. We hear they have such a job, and what a place to use those Fluid Mechanics theories.

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*Bill Riner,* BCE '49, is currently located at the Washington office of Public Works Administration. Bill is a Field Engineer on one of the local projects, and has been seen in Professor Walther's Structures class needling the undergraduates.

———

Some of the many alumni seen at the recent Engineers' Ball were *Vince Toal, Fred Lewis, Al Reidelbach, Walt Cole, Ernie Hix, Jerry Michael* and *Bill Riner.* We even had alumni in the orchestra. *Julian Showkeir* and *Dwin Craig* helped provide the music.

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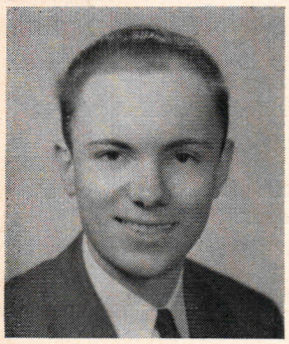
Alumni: *Don't forget those stories.* How about a little dope on some prewar alumni?

# ENGINEERING PERSONALITIES

## UNDERGRADUATE



Probably all of us have met someone who is a jack of all trades and a master of none, an event which is all too common these days. Well, it seems that there is a person at George Washington University who is a jack of all trades and master of all in the person of Bob Custard.

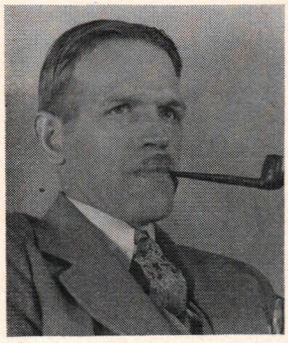
His story began twenty-five years ago in the town Brockton, Massachusetts. At this time Bob's father was instructing at Harvard, which may or may not have some bearing on his future. Five years were spent in getting his feet under him, and then he took off to see the country. During this nomadic period of his life, his education was, in his own words, "hit and miss". Evidently tiring of this life, he settled down in Washington, D.C., at the height of the depression and entered the fifth grade at the age of nine. He joined the Boy Scouts and became an Eagle Scout in that organization.

While at Washington and Lee High School, Bob became interested in drafting, and won a drafting award. At fifteen, Bob set himself up in the drafting instrument business, repairing, buying, and selling drafting instruments, and what is even more amazing, making money at it without subsidization. He graduated from Washington and Lee, highest in the class of 1943. He was actually in the class of 1942, but remained another year to obtain extra credits in mathematics.

After graduation, Bob went to work for the Army Air Corps as a civilian draftsman doing graphic design. He was one of a few civilians, working with the best artists, engineers, and architects in the country, and it was here that he got into the artistic phase of drafting. After a year at the Pentagon he entered the Army Air Corps and went through the usual shuffling around, ending up in Ashville, North Carolina, in charge of the graphic presentation section. At the end of the war, he returned to Washington where he was on the general staff of General Norstadt, doing cartographic work.

Tiring of the oderliness of the army, Bob wandered down to George Washington University on registration day in the fall of 1946. Ah, here was pure chaos! He admits that he was somewhat befuddled for the first few months, but could not have been to badly confused, as he finished his freshman year with a creditable average of 4.0. He started out in Mechanical Engineering, but later changed to a B.S. in Engineering with a Physics major. Since 1947, he has been teaching Physics to occupy his spare time, and somewhere along the way has accumulated enough mathematics for a degree in this subject. At the present time he is in his second year of Law School, collecting another degree.

## ALUMNUS



This month's Alumni Personality, H. Velpeau Darling, is one of the founders and an early President of the Engineers' Council. He was born in Washington, and attended Central High School. Upon graduation in 1921, he accepted a job with the Chesapeake and Potomac Telephone Company, and enrolled as an EE major in the GWU night school.

A year and a half later he was accepted as a student in the American Telephone and Telegraph Company's graduate training school. This school proved to be an easy problem for a man with Mr. Darling's practical experience. Shortly after graduation, he decided that the telephone company was not for him and left for Florida, the "promised land". Several weeks later he had proved to himself that engineers do not make good real estate salesmen, and accepted a position in the office of a landscape architect. While working here he assisted in the layout and planning of the Coral Gables and Belle Isle developments.

When the bubble broke in 1926, Mr. Darling was offered a job as a sanitary engineer in charge of sewer installations in Orlando, Florida. About this time Val realized that if any measure of success was to be achieved in his engineering career he had to get his degree. With his young bride, Val set off for home and the George Washington University. After six years of experience in the engineering world he had changed his mind about his major, and this time he enrolled in the Civil Engineering curriculum.

It was during this second period of enrollment that Val, Tilly Ellenberger, and other engineers realized that the engineering student body needed a central committee to quell the constant civil wars between students in the various departments. The Engineers' Council was the result, and its activities were an immediate success. They have remained so ever since.

On his return to Washington, Mr. Darling worked on the plan of the Chief of Engineers for flood control on the Mississippi River. He has been employed continuously on this project since Congress passed the plan in 1928. Today he is the Chief Civilian Engineer on the Mississippi River Commission, in the Office of the Chief of Engineers. Author of a recent article on Mississippi River Flood Control in "The Military Engineer", Mr. Darling is one of the country's leading authorities on this problem.

Val is a member of the local section of the ASCE, The Washington Engineers Club, Sigma Tau Alumni Association and Theta Tau Alumni Association. He was the recipient of the 1933 Phi Theta Xi Activities Award. When asked for suggestions to student engineers, Mr. Darling expressed considerable concern over the average engineer's lack of ability to express himself, and said he had spent more time since graduation studying English than Engineering.

● Did you ever try to dance with a beautiful girl while she was wearing a bulky fur coat? There was plenty of this at the Sigma Tau party at the Cameron Club somewhere south of Alexandria one cold March night. The heating system at the club had not been working that day and wasn't repaired until the brothers and their dates began to gather. As a result, the early part of the evening was spent huddled around the fireplace. The party threatened to be a disappointment even before entering the club. Such remarks as "Why, it looks like an outhouse!" and "Let's wait outside and see what goes in" were heard, but, in spite of this inauspicious start, a good time was had by all.

Music for dancing was provided by the best dance bands in the country, thanks to the records brought by some of the members and Lynn Garrison's record-playing equipment. Liquid refreshments were on the house, but strangely enough, the food was disposed of rather early, while the liquid remained. Things got so bad that Mike Saba, who got happier as the evening wore on, dispossessed the regular bar tenders and tried to start a bottle-in-every-hand campaign. When Mike was last seen, many bottles were still unopened, but Mike was getting happier than ever.

Conspicuous on the dance floor most of the evening in spite of a bad cold was Will (somebody hold this brew for me) Vary. The only mishap of the evening occurred when Herman Schkolnick (probably trying to point out the merits of magnetic amplifiers) got excited, pounded on the bar, and upset a display of bottles Ed McGandy had built in an attempt to give the bar some class.

By the time the moon had settled into the Potomac, Sigma Tau had once again proved that engineers know how to have fun. The last sounds heard floating through the night air were "When are we going to have the next party?"

● The March program of two meetings of the GWU Student Chapter proved to be one of the most interesting of the school year. The month began with the regular student meeting on March 1, when Mr. Kenneth Bousquet presented an enlightening talk on 'The Planning and Administration of Government Flood Control Projects". Mr. Bousquet is Chief of the Planning Branch, Office of Engineers, Corps of Engineers. The work of the Corps, form the conception of the idea for a project through the various investigations, recommendations of the Engineers, appropriations by Congress and the actual construction and administration of the job itself was thoroughly explained by the speaker and aptly illustrated by a sheet of cartoons depicting the various stages which was given out.

A special feature was added to the month's activities when the students took part in the parent society meeting at the Cosmos Club on March 14. The program was planned and presented by the ASCE Junior Forum with the cooperation of the two local student chapters. The guest speaker of the evening was Mr. Rensselaer Sachs, prominent welding expert, who presented a series of slides illustrating welded steel structures. Following his talk was a period of questions by the audience, and a report of the activities of the George Washington chapter was presented by the President to the District of Columbia Section.

The chapter's 1949-50 schedule will be completed by two more technical meetings on April 5th and May 3rd, respectively, a field trip through the mills of the Alexandria Iron Works, and one party and dance which will be held near the end of the school year.

● At the March meeting of the IRE, Dr. Paul Smith, of the Naval Research Laboratory, spoke on "Piezoelectric Crystals". In his talk he covered the characteristics and preparation of the different synthetic crystals now being produced. He displayed samples of various crystals made by artificial means from different chemical constituents. His most interesting samples showed how the crystals were artificially made.

One process is to place a seed crystal in a tank of the required solution at the right temperature and wait. The crystal grows at the rate of a few inches a day and may grow to any desired length. After the crystal is taken from the tank it is cut along any of its axes, depending on its use. Other processes for making the crystals and some of their applications were described.

Dr. Smith pointed out the various factors which are important in determining the crystal's mode of operation, and why each one has special applications. In conclusion, he stated that the development of piezoelectric crystals is still very much in the cut-and-try stage, and that there is a wide field for research on the subject.

The executive committee is worried about the decline in attendance at the last meeting. We realize that there was an examination following the meeting, but there was little excuse for the poor showing. If there is not a decided improvement the future of the branch looks bad. Anyone having any suggestions contact Fred Battle or any other of the officers. We're trying to satisfy the members, and if you are not pleased with the meetings, let us know why.

● On Wednesday, March 1, the AIEE held its annual prize essay contest. The object of this competition is to train future engineers in thinking and presenting their ideas to an engineer audience. The contestants included Willis Vary, who discussed the miniature selenium rectifier and its use in telephone carrier communication; Bob Wise, who discussed the mechanical permanent oscillagraph; and Bob Zens, who presented an essay on the "Image Orthicon", the television camera pickup tube.

Contestants were judged on their speaking technique, style and organization of material, and their ability to answer questions from the audience about their topic. Judges for the occasion were J. O'Brien of the Rural Electrification Administration, H. Flowers of the Naval Research Laboratory, and B. Slingluff of the Potomac Electric Power Company. The competition was very close, and after an half hour of deliberation the judges arrived at their decision to present the first prize of $10.00 to Bob Zens. Next Mr. Zens will present his essay before the District contest at Lafayette College on April 28th. The winner of that contest will present his essay this summer, before the general meeting of the AIEE at Pasadena, California.

It was disappointing that such a small audience attended, however, this is understandable since the Physics Department cooperated by giving an examination the following morning and many who would otherwise have attended were forced to study. Two of the speakers remarked that they wished they could have stayed home and studied—even before they flunked the Physics examination.

● The March meeting of the ASME student chapter featured an address by R. J. Pigott of Gulf Oil Company's experimental laboratory in Pittsburgh. The subject of Mr. Pigott's talk was "High Output Engines." He discussed modern internal combustion engines and factors affecting their operating characteristics, efficiencies, and losses.

April will be ASME month here in Washington. On Wednesday, April 5th, the ASME Student Chapter will hold its regular meeting at 8:30 P.M. in the Government Building. From Wednesday, April 12th to Friday, April 14th, the parent society of the ASME will hold its Spring Convention at the Statler Hotel. The meeting will feature technical sessions on oil and gas power, fuels, management, machine design, heat transfer, education and many other subjects that are of interest to the engineer. In addition to technical sessions, there will be inspection trips to such places as the Naval Ordnance Laboratory, PEPCO's new Alexandria Power Generating Station, the Navy's David Taylor Model Basin at Carderock, the Bureau of Standards, the U. S. Naval Academy at Annapolis, the Timber Engineering Company laboratory, and the U. S. Naval Experimental Station.

On April 14th and 15th, the annual Region III Student Convention of the ASME will be held at the Naval Academy, Annapolis, Maryland. Each member school will send one delegate, who will present his technical paper in the annual student competition. This year's delegate will be Harry Croswell, winner of the local student paper competition at the February meeting. At this writing the details of the student convention aren't known, but by the time of the April meeting we shall be able to give full information. Let's have a big turnout at the meeting.

● On March 25th Gamma Beta Chapter was host of the Biennial Regional Conference. Members from Rho (N.C. State College of Agriculture and Engineering), Pi (University of Virginia), Theta (Columbia University), and Tau (Syracuse University) joined with our chapter in discussing matters of interest to the fraternity. In the afternoon the entire group assisted in the initiation of the pledge class.

Following the initiation the members attended a banquet and dance at the Hotel Burlington. Both were a grand success, and Bob Lee provided his usual style of satisfying music.

Many of the alumni of the local chapter joined the tals made by artificial means from different chemical regular members at the banquet, at which Professor N. B. Ames, Grand Regent of the fraternity, acted as Master of Ceremonies, introducing the alumni present as well as the speakers. Three of the former Regents of the local chapter were present, Don Blanchard, Merrill Brown and George Kilpatrick. Donald Curtis, Grand Vice Regent of the fraternity, gave a short talk, following an address of welcome by Dean Frederick M. Feiker, honorary member of the local chapter.

The chapter is looking forward to another rush party, that will probably be held sometime in April. Final plans for this party are to be completed soon, and will be announced at that time.

New members who were initiated during the conference included W. H. Seabrooke, Charles Plyer, Judson Hulsey, Alfred Moe, William McMakin, Edward Davitt, Samuel Collins, Frank Williams, Joseph Rekas, William Hunley, Edward Caldwell and Clarence Becraft.

Election of chapter officers for the coming school year will take place at a meeting sometime in April, to be announced later.

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UNIVAC—(*Continued from page six*)

great savings by sending their work to a computing service company. Such a company, operating a system such as the UNIVAC System, would have a staff to prepare and compute whatever type of problems its clients might have. The staff might also include accountants, mathematicians, statisticians, and methods experts to assist small firms who would be unable to operate such a system on their budget.

Electronic computing offers wide new fields of endeavor. Those who will be able to make use of the computers in Science, Engineering, and Business will find that they have an invaluable new tool. Knowledge of ultra high-speed computers and their applications will be of great value to such persons. Equal opportunity awaits those who will be engaged in design and construction of the machines. It is a field of study that is now at its beginning. Applications of the machines are for the most part yet to be discovered.

It is easy to visualize a central department of a large business organization which will be under the direct control of top management. This department will be centered about a high-speed, automatic computing system such as the UNIVAC System. Its staff will include personnel competent to prepare problems for the machine and to interpret results. Operators will be thoroughly trained to make most efficient use of the computing system. Most of the staff will be engaged in preparing tapes in advance, and may work a single shift. The computer itself, however, can operate through two or three shifts, and may at times run unattended. The department will aim to keep the computer busy around the clock.

Departments through the enterprise will send material to this central location. From Engineering and Research departments will come scientific problems which are uneconomical to compute manually. Statistical problems, perhaps from the field of Market Research or Quality Control, will be set up by staff members of the department. Inventory control, sorting, alphabetizing, accounting—all will be unburdened of expensive routine or special tasks which are now done by hand. Even predictions concerning the national economy, now made by laborious and inadequate methods, may some day be made possible by such machines as our knowledge of prediction improves. For the first time, it will be possible to digest the vast amount of data necessary to provide even a partially satisfactory solution to so ambitious a problem.

The following references will be especially interesting to those who wish to learn more about machines of the type discussed in this article.

> *Giant Brains, or Machines That Think*, by Edmund C. Berkeley. John Wiley and Sons, New York, 1949.

This book describes several of the first large-scale computers and discusses the whole field in a very readable and understandable manner. It also contains a comprehensive list of references to many types of articles in the field.

> "Coding of a Laplace Boundary Value Problem for the UNIVAC," by Frances E. Snyder and Hubert M. Livingston. *Mathematical Tables and Other Aids to Computation*, III, Number 25, January, 1949.

This article describes the UNIVAC System briefly, gives the explicit coding required to solve the problem considered on the UNIVAC, and discusses some modifications of the problem.

> "Electronic Accounting and Inventory Control", by John C. Sims, Jr. *Railway Purchases and Stores*, June, 1948.

This article contains a description of the UNIVAC and how it can be applied to inventory control operations.

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DESIGN—(*Continued from page nine*)

design, the driver will be overloaded. On a new design, the test stand frequently uncovers one or more shortcomings of the product and every resource of the designer is often called upon to remedy matters. This is usually done under pressure, as by the time the unit gets to the test stand the customer is clamoring for delivery. The designer must be precise, resourceful, and exhibit the judgment of Solomon under pressure.

(5) Metallurgical and Chemical Laboratory: Most large organizations have departments or individuals which specialize in metallurgy, corrosion, electric controls, bearing design and similar problems which require intensive study in one field. Every engineer tends to specialize in some particular field, either by choice or by assignment. The designer who looks to his future seeks out the full resources of his organization and associates and does not hesitate to avail himself of their services and guidance. The design engineer acquires broad experience in direct proportion to his ability and his initiative. The Engineering Department is no place for laziness and it is a dead alley for anyone who evades responsibility.

The individual who wants to become an outstanding specialist in some particular field can fulfill that ambition. He must take advanced studies, must follow the literature in his particular field, must write for the technical press, attend technical society meetings dealing with subjects in his field of interest, and keep his own organization up-to-date on every development of commercial interest. His field of specialization must pay dividends to his company. A field of interest that does not pay its way had best be reserved for an after hours hobby.

There are opportunities for advancement in the division itself to Product Engineer or Chief Engineer, and then into the broader fields, such as Executive Engineer, Vice President in Charge of Engineering, etc. All of these positions are invariably filled exclusively by men who have come up through the design end of the organization. However, even broader advancement opportunities exist. In general, Engineering department training forms the best basis for positions as Shop Superintendent, Service Manager, Production Manager, Plant Manager, and even into the Sales and top executive management structure of the organization. Even if an individual does not aspire to be an "expert" or a "brass hat", the field of machine design covers a breadth of experience that is in effect the "know how" of his organization. Of necessity, therefore, the designer's position has a job security that can be of real comfort during the recurring low periods of business activity. For the happiness of a family this is a feature of basic significance.

To do a successful job of designing, it is desirable first to accept a position that will allow you to spend about one year on the test stand or in the Department which does development testing. This allows you an opportunity to become familiar with the machines you will design and to learn a great deal about how to set them up, operate them, and care for them. You can also observe their features and faults. Of course, some of the machinery will not perform at first as anticipated and you will learn many valuable lessons adjusting, dismantling and reassembling it. During this period you will meet the design engineers and pave the way to being accepted in the Engineering Department.

After a year of practical work, it is desirable to get started on design work and possibly to spend one to two years doing essentially subordinate work, "sawing wood". Thus you will find out a great deal about design methods and procedure and establish good relations with design draftsmen and clerical help in the department. To complete your professional "internship" for design, it would then be desirable, if at all possible, to spend a few months in the shop again, assigned to the Inspection and Methods and Standards departments. In the Methods and Standards department you will learn about the

(*Concluded on next page*)

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detailed routing of the machine components through the shops, and something about the speed and cost of various machines and manufacturing operations. You will become familiar with the limitations of the tools that are available. The Inspection department will give you a further insight into what accuracy can be expected and the thousand and one things that can lead to defective material and work. If a further short period can be spent in the field-servicing of equipment, you will be in a position to do responsible and creative design and application engineering.

*"Twelve Proverbs for Young Engineers"*

1. Formulas are useful engineering tools, but poison to education—a substitute for thinking.
2. The good engineer knows how to figure distances, areas, volumes, weights, speeds, power, costs, etc. He also knows how to make good "guesstimates" in a hurry.
3. Every young engineer should learn the ABC's of practical business buying, selling, letter writing, records and accounts and simple office routine.
4. Whatever his title, every engineer must be a salesman to get people to adopt his ideas and cooperate in the completion of his projects.
5. To go places is an organization, be known as the man who does what he said he would do and gets it done on time.
6. To succeed, an engineer must learn how to get along with the man above, the man alongside, the man below and himself.
7. The most common and important engineering operations are talking and writing.
8. In general, a man is made an executive not because he is outstanding in any respects but because the other candidates are badly lacking in some essential quality.
9. The young graduate should not try to impress his fellow workers with the extent of his knowledge. The truth will leak out soon enough.
10. Never assume that something will get done just because you arranged to have it done. If the matter is important check, recheck, and then check again.
11. Pick the right wife and learn how to get along with her.
12. For a full and happy life watch your health, keep peace with your neighbors and your conscience, be a good citizen, do some physical work at home, have some fun, cultivate a sport or a hobby, and sample the best in the fine arts.

As a further reference, I can strongly recommend reading "The Unwritten Laws of Engineering" by W. J. King. This paper was published in 1944 by the ASME and is available in reprint form for 25 cents a copy.

The design engineer knows the technical aspects of the company's products and manufacturing processes. If he has the leadership capacity, the business acumen, the ability to talk and write, and is willing to make the necessary sacrifices to fulfill his ambition, he can usually point toward and achieve the position he wants.

As important as its economic aspects is the fact that the field of machine design is inherently a creative one. There is an important feeling of accomplishment in creating and supervising the building of a machine and watching it perform its predetermined functions. In the commercial field the designers work finds its way, in time, to all parts of the country. It often has world-wide distribution. The nameplane on each machine never fails to warm the designer's heart, for it is the label of the team on which he is the key man.

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## D.C. CONSTRUCTION BUDGET

The District of Columbia's budget, recently submitted to Congress, included requests for funds on five main projects, and requests for funds to begin work on several smaller projects, as well as a number of improvements to existing facilities.

Authorization was requested for a total of $6,467,000 in projects for replacements and additions to elementary and high schools, but only a part of this was requested for immediate work. Howard University's building program, which has run to approximately $5,700,000 this year, had an additional request in the budget for $1,994,000 for carrying on this program.

A $10,000,000 fund was sought to start the job of overhauling the Capitol power plant and distribution system. This job is expected to run to a total of $16,000,000 before it is completed. The request for sewer construction totaled $3,443,000, which included $2,100,000 to start improvement of the Blue Plains sewage treatment plant. A request for $2,233,000 was included in the budget for facilities increasing the water supply, and $1,812,000 was requested toward the replacement of two deteriorated and obsolete hospital buildings, which are expected to cost a total of $5,000,000.

METALS—(*Continued from page seven*)

of the transformer and induces a signal in the secondary of the transformer. This secondary circuit is then connected to a two stage electronic amplifier from which the magnified signal is thrown on an oscilloscope or some other indicating device.

Maintaining a temperature of 14°K is not an easy task; Dr. Horn accomplished this by the use of a cryostat. This is a cylindrical can about 15 inches long and 5 inches in diameter. The outer case, which is the outer part of a vacuum jacket, is made of monel metal .025 inches thick. Inside of this is a double walled cylindrical can also of monel metal containing 1 liter of liquid nitrogen, which maintains a temperature of 77°K. Inside of this, and separated from it by a small space, is a can containing 1 liter of liquid hydrogen, which maintains a temperature of 14°K. Leading from this can and thermally attached to its base is the columbium nitride strip, protected by shields from surrounding radiations.

Neglecting atmospheric absorption, this instrument is sensitive enough to detect the heat of a candle 25 miles away. It has a speed of response of one-half to one-quarter of a millisecond, and will detect a single pulse of radiation containing as little as $10^{-6}$ ergs. If installed in a warehouse, the bolometer would be able to detect an intruder in complete darkness, transmit the picture by wire for an almost unlimited distance, and present the picture on a television screen at a central station.

It appears that any practical application of the bolometer for such purposes will depend on the development of compact self-operating refrigerating units capable of developing 14°K. Very low temperatures and ultra deep refrigeration promise great things both for science and industry, for it has been said that the laboratory experiment of today becomes the industrial process of tomorrow.

COUNCIL—(*Continued from page eleven*)

shop) was again brought up, although perhaps not too seriously.

The February meeting of the Council was held the day before the Engineers' Ball. Each of the Council members reported the number of tickets that they had sold. As the tickets were reported they were checked off a large chart listing each ticket, designed to help in keeping down the confusion at the door. The fact that many engineers waited until the night of the dance to buy their ticket left the Council in doubt as to the financial standing until the last minute.

Beverly Howser, an engineering coed at the University, was selected to pick the winning numbers for the door prize. Completing the plans for the Engineers' Ball was the decision to give out balloons at the door to add to the gaiety of the evening.

The last meeting of the Council was held on March 9th, at 8:15 p. m. The first item of business was a complete financial statement on the Mecheleciv. This was followed by a report on the Engineers' Ball. Dick Daniels reported that the Ball made a profit of about $50.00, approximately the same as last year.

It was proposed from the floor that each organization elect one Council delegate from the Senior class and one from the Junior class in the future, in order to have more two-year delegates on the Council hereafter. An amendment to the Constitution was moved and seconded to the effect that neither delegate to the Council from an organization shall be President of the organization from which he is a delegate. This amendment was passed unanimously, and is now being presented to the societies and fraternities for their ratification. If the amendment is approved by two thirds of the six societies and fraternities involved, it becomes effective.

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